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REPORT NO. [redacted]

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COUNTRY Czechoslovakia

DATE DISTR. 1 April 1954

SUBJECT Maintenance and Inspection of the Czech M-05 and Soviet MIG-15 Jet Engines

NO. OF PAGES 13

DATE OF INFORMATION [redacted]

REFERENCES:

PLACE ACQUIRED [redacted]

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General

1. Personnel conducting an engine inspection usually consisted of:

   Flight technician (crew chief)
   Aircraft technician
   Assistant aircraft technician

   Additional help was given by the electrical technician when needed.

2. In addition to the regular inspection and maintenance periods, the engine oil was changed to winter-grade during the period 15 October - 15 November. Change to summer-grade oil was made during 15 March - 15 April.

3. Source knew that each engine came with a factory guarantee. However, he did not know if this period were for one year or longer. If the engine failed for any reason before the guarantee period a commission from the factory was supposed to come out and inspect the engine. He did not know any further details.

4. In addition to pre-flight and post-flight engine inspections, a periodic inspection schedule was carried out. First and foremost there are two very important considerations:

   a. Engine inspection periods are based on the total time accumulated on the engine which includes 100% of the flight time plus 100% of the ground running time. The engine running times are kept in the engine log book (see Encl. 1 and 2).

   b. Engine life is arrived at by using 100% of the engine flight time accumulated plus 20% of the ground running time accumulated for the same period. For example, a 180-hour engine life may be reached when the flight time on the engine is 172 hours and the ground running time 40 hours for the same date (20% of the 40 hours is 8 hours which added to the flight time of 172 hours equals 180 hours). This last consideration is important since the actual engine running time will always be greater than the engine life which the Soviets specify for their engines (assuming they also use the 20% ground-time rule). As a result, for an engine whose life is specified as 180 hours the inspection periods may run up to 200, 225 hours, etc., depending on the ratio of ground to flight time. Source stated that of the total time accumulated on an engine, approximately 12-15% is ground running time.

5. The engine and aircraft maintenance and inspection procedures used by the Czech Air Force were derived from Russian manuals which were translated into the Czech language. Therefore, the procedures listed in the following pages can also be applied to Soviet jet aircraft and engines.

Engine Life

6. The Czech-built M-05 engine in the S-102 had a specified engine life of 100 hours. The Soviet-built engine (presumably the RD-45f) in the MIG-15 had a specified engine life of 180 hours. As a result, more care was taken with the inspections of the Czech-built engines. Source stated that the Czech-built engines "weren't as good"; material and combustion chamber (inner liners) failures frequently occurred. Up to May 1953 the same inspection procedures were used on the Czech-built M-05 as on the Soviet-built engine. However, since so many combustion chamber failures occurred (mainly cracks and burn spots), after May 1953 more stringent measures were enforced (see below).

Inspection Periods for Czech-Manufactured M-05 Jet Engines:

7. 25-Hour Inspection:

a. Disassemble all nine combustion chambers (previous to May 1953 only two combustion chambers were disassembled and inspected). Inspect the inner liner (flame tube) for cracks, holes, burn spots, etc. If any crack was longer than one millimeter the liner was replaced (for cracks less than one millimeter holes were spotted and drilled at each end to prevent further progression of the crack, (thus: ▶——◀). Any burn spot through the metal also was cause for replacement of the liner.

b. Visually inspect all nine fuel nozzles and wash with cleaning fluid (they were not bench-tested). The nozzles were completely disassembled during the cleaning operation.

c. Inspect both torch igniter plugs (done by electrical technicians).

d. Visually inspect rubine blades for chips, cracks, etc. Check clearance and play in root attachment (Source did not know allowable clearance). Also, inspect nozzle guide vanes for cracks, chips, burn spots, etc.

e. Inspect compressor air inlet screens for tears, entrance of foreign objects, etc.

f. Inspect compressor inlet for foreign objects and toroidal air inlet guide vanes for chips, cracks, etc.

g. Inspect exhaust duct interior including inner fairings. Also visually inspect outer casings for holes, cracks, etc.

h. Inspect interior and exterior of tailpipe for burn spots, buckling, etc.

i. Remove all four thermocouples and inspect (done by electrical technician).

j. Inspect all hydraulic, oil, fuel, and air pressure lines and connections.

k. Inspect all electrical connections and equipment (done by electrical technician).

l. Remove and clean low-pressure fuel filter and oil filters (the low-pressure fuel filter was also removed and washed every 10 hours).

m. Check oil and hydraulic fluid levels.

8. 50-Hour Inspection:

Same inspections on items a through m as specified in the 25-hour check above. In addition, the engine fire-extinguisher system was checked for proper operation, charge, etc.

9. 75-Hour Inspection:

Same procedure as 25-hour inspection.

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10. 100-Hour Inspection:

More detailed than the 50-hour inspection, but Source did not know what this encompassed. Note: The engine life was given as 100 hours (see definition in previous discussion); there were instances when a 125-hour inspection would be reached. If so, this would follow the same set procedure as the first 25-hour inspection. All inspections were carried out without removing the engine from the airplane. When a life of 100 hours was reached the engine was removed and shipped out to either the factory or central overhaul depot (Source wasn't sure which). Source didn't personally know of any M-05 engine that had accumulated enough hours to fulfill this 100-hour engine life specification.

Inspection Periods for Soviet Manufactured MIG-15 Jet Engine

11. 25-Hour Inspection:

a. Disassemble and inspect only two combustion chambers. Inspect for the same items listed for the M-05 engine.

b. Disassemble, clean, and inspect only two fuel nozzles.

Items c through m, carry out same inspections as listed for the M-05 engine.

12. 50-Hour Inspection:

a. Disassemble and inspect all nine combustion chambers. Inspect for same items listed for 25-hour inspection.

b. Disassemble, clean, and inspect all nine fuel nozzles.

Items c through m, carry out same inspections as listed for the M-05 engine. In addition, the fire-extinguisher system was checked for proper operation, charge, etc.

13. 75-Hour Inspection:

Same procedure as for 25-hour inspection.

14. 100-Hour Inspection:

More detailed than the 50-hour inspection, but Source did not know what this constituted.

15. The engine continues to be inspected every 25 hours until a life of 180 hours is accumulated. (The 200-hour inspection would correspond to the 100-hour inspection, etc.) In some instances it was possible to pull a 225-hour inspection before the engine life of 180 hours was reached. Source knew of two Soviet engines that had completed the 180-hour engine life; one in April 1953, the second in November 1953. One engine was disassembled and sent to a school in Slovakia to be used for instruction and classroom purposes. The other Soviet engine was sent to Kbely. Source did not know if the Soviet engines were handled separately from the Czech M-05 engines when sent away for overhaul.

MIG-15 and S-102 Engine Reliability

16. Source stated that the Soviet-manufactured jet engine in the MIG-15 fared much better than the Czech-built M-05. The main cause of difficulties was combustion-chamber liner (flame tubes) failures. This could have been caused by defective material or poor fabrication techniques. At the first 25-hour inspection an average of three to four combustion chamber liners had to be replaced on the M-05. (This

also occurred on every subsequent inspection, e.g. 25, 50, 75, 100, etc.). Source could remember only one case where a Soviet engine had to have a liner replaced at 75 hours. (There were only three Soviet-built engines in his staff regimental flight.) It is interesting to note that the Soviet engines were repaired with Soviet-built spare parts, while the Czech M-05 engines were repaired with Czech-built spare parts. Source remembered that the damaged combustion chamber liner in the Soviet engine was replaced by a Soviet combustion-chamber liner spare in May 1953. However, by July 1953 they ran out of stock and Czech-made liners were being used for spare parts in the Soviet engines (presumably by the other squadrons, etc.).

17. This close inspection of the Czech M-05 is further evidenced by the change in inspection procedure after May 1953, namely, inspecting all nine combustion chambers instead of only two as had been done. This was brought about by excessive combustion-chamber failures.

18. Source stated that the Czech M-05 was "getting better" and may approach better reliability. However, as of February 1954 the engine life of the M-05 was still only 100 hours, while the Soviet engine in the MIG-15 (RD-45f) had a specified life of 180 hours.

19. The chief difficulties encountered with the Czech M-05 were material failures which could have been due to poor materials, fabrication techniques, or quality control procedures. Source recalled an experience that occurred in his regiment with a hydraulic pump drive-shaft failure. Nearly all engines installed in the S-102 220 series (airplane serial numbers all starting with 220 e.g. 220xxx, etc.) experienced a complete failure of the hydraulic-pump drive shaft (shaft would twist and break) after only 12 hours of running time. Nothing was done even after repeated complaints ("UR's" were written) about the engine failures in the 220 series of aircraft. Instead of grounding the aircraft and inspecting all the drive shafts for faults and possible replacement they just waited until they broke, and then replaced them with a new drive shaft (evidently one whole batch of hydraulic-pump shafts were either heat-treated improperly or improper material was used).

Maintenance and Inspection of the S-102 Airframe and Equipment

20. Source's knowledge of the maintenance and inspection of the S-102 airframe and equipment was very limited since he did not have direct contact with the actual work. The general crew consists of a

Flight technician - crew chief or leader
Aircraft technician - worked on engine during engine
Assistant aircraft technician - inspection
Radio aircraft technician
Electrical aircraft technician
Assistant electrical aircraft technician
Armament aircraft technician

Booster Controls

21. The aileron booster control unit is disassembled and inspected every 12-1/2 hours (of flight time on the airframe). Every 50 hours the booster control unit is disassembled and given a more rigid inspection. All inspections of the booster control unit are carried out in the workshop.

Landing Gear

22. After every 10 landings the aircraft was jacked up, air let out of the tires, wheels removed, and brake drums and wheel interior inspected and cleaned. There was also a more detailed inspection after every

50 and 100 landings (Source did not know the average number of landings on a set of tires since new pilots wore the tires out quickly and the more experienced were easier on the landings and tire wear). The tires were changed when the cord showed.

After every 400 landings the main gear-attachment fitting (pin) on each main strut would be replaced.

Airframe

23. In addition to routine pre-flight and post-flight inspections, every 25 hours (25, 50, 75, 100, etc.) the airframe and controls were inspected. Nothing was disassembled; control cables were visually inspected, connections greased, silica-gel capsules replaced, ejection seat taken out and checked, etc. Source also stated that a major inspection is performed once in the spring and again in the fall (he did not know what it consisted of).

Each regiment tried to do as much of their own maintenance work as possible; however, if a major change was being made on an airplane such as changing a complete wing panel, a commission of experts from the aircraft factory would have to be called to supervise and ensure that the "characteristics or appearance of the aircraft was not changed". (Source did not know if this also referred to horizontal and vertical stabilizer sections, landing gear, etc. He only knew of this one example.)

S-103 and M-06 Engine

24. Source had no information on the maintenance, inspection, or operation of the S-103 (with M-06 engine) and MIG-15 Bis (with VK-1) engine. He had never seen either engine.

Log Books

25. Source was asked to draw a facsimile of some log-book pages which were in current use on the S-102 aircraft and engine (see Enclosures 1, 2, 3, 4, 5). There were two log books that he knew of; one for the engine, the other for the aircraft.

a. Enclosure 1 represents a page from a series located in the front section of the (M-05) engine log book (it was about 2" thick). The column headings are self-explanatory (Source stated that the columns, "max. rpm", "fuel pressure", and "tailpipe temperature" were filled out as a matter of record only - whatever was the first reading the column was continued on down the page. Hardly anyone took the time to make a physical check of these three readings).

b. Enclosure 2 represents a page from a series located in the middle section of the M-05 engine log book. The monthly and accumulated time on the engine was kept on these pages. At the end of the month the mechanic and technician initialed the entries.

c. Enclosure 3 represents a page from a series located in the rear portion of the M-05 engine log book. These pages were used to record dates of the periodic inspections (25, 50, etc.) and the type of maintenance work performed.

d. Enclosure 4 represents a page from a series also located in the rear portion of the engine log book. These were used to record daily entries performed during pre-flight and post-flight checks.

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e. Enclosure 5 represents a page from a series in the log book of the S-102 airframe. A record of the landings is also kept on this page. Interesting to note is the entries for "pull-ups" or accelerated turns. Source explained this by saying that any maneuver such as chandelles, immelmanns, loops, or any maneuver involving a fast pull-up (thereby subjecting the airframe to "g" loads) would be recorded (the pilot wrote the total for each flight). After about 200 such maneuvers the airframe would be closely inspected for any structural damage.

f. Tailspins are not practiced in the S-102 or MIG-15. If a tailspin is practiced, the airframe is closely inspected for structural damage (Source knew of two cases where S-102's went into spins - both crashed).

g. There were additional pages in the aircraft log book but Source could not recall their contents.

Graphs

26. One of Source's primary duties while working in the office of the regimental technical officer was keeping up-to-date charts on the various aircraft, engines, etc. Such a chart is reproduced in Enclosure 6. All the aircraft were listed on the left by number (nose number only) and three running bar graphs were made for each aircraft; total engine hours (100% flight time plus 100% ground running time; this graph would indicate when the periodic 25-hour inspections were due), total aircraft flying hours (which would indicate when the periodic 25-hour aircraft inspections were due) and the total number of landings (which would indicate when the tire and wheel inspections were due.)

Source stated that the average flying hours for the year (jet aircraft) was about 15 hours per month (summer months up to 25 hours per month, winter months lower).

Comments

27. Source mentioned a night-fighter version of the MIG-15 Bis. His statement was based on the increased instrument-flying capability of the MIG-15 Bis due to installation of ARK automatic radio compass and radio altimeter. There is not a modified version of the MIG-15 Bis (such as radar, etc.) other than described in this report, which is the same type of airplane described in ATI-628-53 (Polish Air Force MIG-15).
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Enclosures:

1. Facsimile of Page engine Log-book Daily Report Section
2. Facsimile of Page from Engine Log book, Monthly Report Section
3. Facsimile of Page from Engine-Book Periodic Inspection Sheets
4. Facsimile of Page from Engine Log-Book Daily Inspection Sheets
5. Facsimile of Page from Airframe Log-Book Daily Report Section
6. Aircraft & Engine Time-Record Sheets

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Enclosure 1: Facsimile of Page Engine Log Book Daily Report Section

Day	Month	Year	Pre-Flight Entries: Maximum RPM Ground running	Pre-Flight Entries: Fuel Pressure Ground running	Pre-Flight Entries: Tailpipe Temp C Ground running	Engine Ground Running Time: Hours	Engine Ground Running Time: Minutes	Engine Flight Time: Hrs.	Engine Flight Time: Min.	(Flight Ground) Total Engine Time: Hrs.	(Flight Ground) Total Engine Time: Min.	Technician's Initials

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Enclosure 2: Facsimile of Page from Engine Log Book Monthly Report Section

Month	Engine Ground Time		Engine Flight Time		Total Ground Time		Total Flight Time		Mechanics' Initials	Flight Technician (Crew Chief) Squadron Tech. Regimental Eng.
	Hours	Minutes	Hours	Minutes	Hours	Minutes	Hours	Minutes		
January										
February										
March										
April										
May										
June										
July										
August										
September										
October										
November										
December										

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Enclosure 3. Facsimile of Page From Engine Book

Periodic Inspection Sheets

DATE		Periodical Works (Inspections)	Technicians' Initials
Day			
Month			
Year			

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Enclosure 4. Facsimile of Page From Engine Log Book

Daily Inspection Sheets

Date		
Day		
Month		
Year		
Daily Repairs		
Technicians' Initials		

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Enclosure 5. Facsimile of Page From Airframe Log Book 50X1

Daily Report Section

Day	Month	Year	Pilot	Mechanic	MAX. Flight Altitude	Number Of Landings	Number of "Pull-Ups" or Accelerated Turns	Flight Time Hours Min.	Total Number Landings	Total Number of Pull-Ups or Accelerated Turns	Total Flight Time Hrs. Min.

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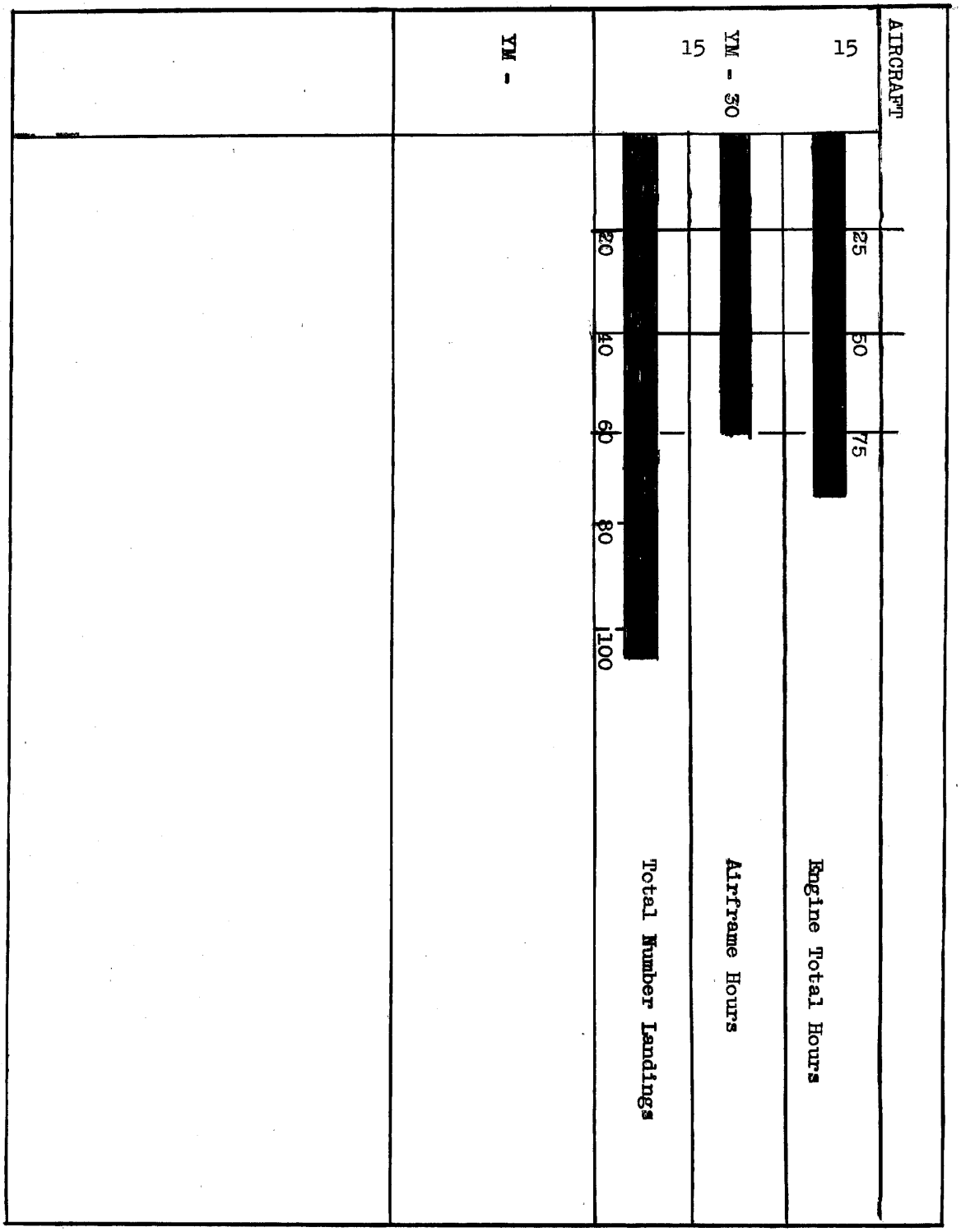
Enclosure 6. Aircraft & Engine Time-Record Sheets



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